



**Scenario**  
DOCTORAL TRAINING PARTNERSHIP

**NERC**  
SCIENCE OF THE  
ENVIRONMENT

## Millennial-Scale History of Amazon Forest Dynamics

**Lead Supervisor:** Francis E. Mayle, University of Reading, Department of Geography & Environmental Science, SAGES

Email: [f.mayle@reading.ac.uk](mailto:f.mayle@reading.ac.uk)

**Co-supervisors:** Stuart Black, Department of Archaeology, SAGES; Shovonol Roy, Department of Geography & Environmental Science, SAGES

### Background

Studies of a network of 1-hectare forest plots across Amazonia have revealed significant ecological changes (e.g. increasing biomass) over recent decades, but whether they reflect atmospheric change (e.g. fertilization from rising CO<sub>2</sub> concentrations), or instead secondary succession following pre-Columbian (pre-AD1492) human disturbance, is controversial. Furthermore, the likely impact of increasing drought over the 21<sup>st</sup> century, predicted by climate models, is also uncertain. A palaeoecological approach can potentially reveal the impact of mid-Holocene drought (a potential analogue for future drought) as well as Pre-Columbian land use. However, a major disadvantage with lake-based pollen analysis (the traditional palaeovegetation proxy) is that suitably old lakes are rare in Amazonia, and the spatial resolution of pollen records is generally far too coarse to enable meaningful comparison with ecological data from 1 ha plots. **The aim of this project** is to circumvent this problem by using a novel suite of palaeoecological proxies from soil profiles to reconstruct the millennial-scale vegetation histories of individual 1 ha plots of different types of forest across ecotonal southern Amazonia.



### Approach and Methods

**Phytoliths** (microscopic silica bodies) are diagnostic of different plant taxa and, crucially, unlike pollen, are well preserved in soils and reflect plants growing *in situ*, thus facilitating direct comparison between ecological and palaeoecological data from the same forest stand. **Stable carbon isotope analyses** differentiate C<sub>4</sub>-dominated savanna/open ground vs C<sub>3</sub> forest, while **charcoal** and **geochemistry** reveal fire history and soil properties, respectively. Previous research shows that these soil pits likely span at least 6,000 yrs BP, and will thus enable the respective impacts of mid-Holocene drought and pre-Columbian land use to be explored. Floristic and **ecological data** will be

downloaded from the RAINFOR database. Appropriate **numerical and statistical analyses** will be undertaken to reveal intra- and inter-site relationships between different ecological, geochemical and palaeoecological data.

### Training opportunities:

Training will be provided in phytolith and charcoal analysis (Mayle), stable isotope and geochemical analyses (Black) and numerical/statistical techniques (Roy). Although most soil samples have already been collected, there will be an opportunity for the student to undertake fieldwork in Amazonia and collect more material.

### Student profile:

At least a 2.1 BSc degree in biology/geography/environmental science is required. A strong background in numerical/statistical techniques is essential. Knowledge of ecology, biogeography, Quaternary science, and microscopy would be advantageous.

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